An Approach towards Semantics-Based Navigation in 3D City Models on Mobile Devices

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Abstract

This paper outlines a novel approach for user navigation in complex virtual 3D city models on mobile devices. Users navigate within the virtual 3D city model by sketching navigation commands in the perspective view on the mobile client. The sketches are sent to the server, which reprojects the sketches onto the 3D scene, interprets these sketches in terms of navigation commands, and sends the resulting video-encoded image stream to the mobile client. This approach allows us to provide interactivity for complex virtual 3D city models on resource and bandwidth limited mobile clients. A high degree of usability is achieved because users can trigger complex navigation commands in a task and goal oriented way taking advantage of the navigation properties and affordances inherent to elements of geovirtual environments.

1 Motivation

Virtual 3D city models represent urban spatial and geo-referenced data by 3D geovirtual environments (GeoVE) that include terrain models, building models, vegetation models as well as models of roads and transportation systems. In general, these models serve to present, explore, analyze, and

manage these urban information spaces and, therefore, constitute a major user-interface paradigm for 3D geoinformation systems.

An increasing number of applications and systems incorporate virtual 3D city models as essential system components such as for facility management, logistics, security, telecommunication, disaster management, location-based services, real estate portals as well as entertainment and education products. Consequently, a large number of potential users and usages require an efficient and effective mobile access to virtual 3D city models and their contents.

We present a novel solution for accessing virtual 3D city models on mobile devices. The user controls the navigation within the virtual 3D city model by navigation command sketches drawn directly on the view-plane of the mobile client (Fig. 1). The sketches are sent to the server, which reprojects the sketches onto the 3D scene correlating the sketches to scene objects, interprets these sketches in terms of navigation commands, and sends the resulting video-encoded image stream to the mobile client. That is, the mobile client enables users to specify and retrieve step-by-step created video sequences that correspond to their navigation intentions.

Fig. 1. Sketching the navigation command "look around" (left). Sketching the navigation command "walk along the path and, finally, look at the indicated building" (right).

2 Related Work and Challenges of Mobile 3D City Models

Mobile applications of virtual 3D city models represent a major and complex research challenge due to limited bandwidth and graphics capabilities, restricted interaction capabilities, data standardizations and distribution techniques, and digital rights issues.